

# Semiautomated Glasgow-Blatchford Bleeding Score helps direct bed placement for patients with upper gastrointestinal bleeding

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**To cite:** Schembre DB, Ely RE, Connolly JM, *et al*. Semiautomated Glasgow-Blatchford Bleeding Score helps direct bed placement for patients with upper gastrointestinal bleeding. *BMJ Open Gastro* 2020;**7**:e000479. doi:10.1136/bmjgast-2020-000479

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bmjgast-2020-000479>).

Received 18 July 2020  
Revised 13 October 2020  
Accepted 23 October 2020



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## ABSTRACT

**Objective** The Glasgow-Blatchford Bleeding Score (GBS) was designed to identify patients with upper gastrointestinal bleeding (UGIB) who do not require hospitalisation. It may also help stratify patients unlikely to benefit from intensive care.

**Design** We reviewed patients assigned a GBS in the emergency room (ER) via a semiautomated calculator. Patients with a score  $\leq 7$  (low risk) were directed to an unmonitored bed (UMB), while those with a score of  $\geq 8$  (high risk) were considered for MB placement. Conformity with guidelines and subsequent transfers to MB were reviewed, along with transfusion requirement, rebleeding, length of stay, need for intervention and death.

**Results** Over 34 months, 1037 patients received a GBS in the ER. 745 had an UGIB. 235 (32%) of these patients had a GBS  $\leq 7$ . 29 (12%) low-risk patients were admitted to MBs. Four low-risk patients admitted to UMB required transfer to MB within the first 48 hours. Low-risk patients admitted to UMBs were no more likely to die, rebleed, need transfusion or require more endoscopic, radiographic or surgical procedures than those admitted to MBs. No low-risk patient died from GIB. Patients with GBS  $\geq 8$  were more likely to rebleed, require transfusion and interventions to control bleeding but not to die.

**Conclusion** A semiautomated GBS calculator can be incorporated into an ER workflow. Patients with a GBS  $\leq 7$  are unlikely to need MB care for UGIB. Further studies are warranted to determine an ideal scoring system for MB admission.

## BACKGROUND

Patients with upper gastrointestinal bleeding (UGIB) often present dramatically with haematemesis or melena, hypotension and even syncope. Because the aetiology of bleeding is usually unknown and behaviour uncertain at the time of admission, even stable patients may be admitted to a high acuity intensive care unit (ICU) with continuous patient monitoring and close nursing care. However, most patients with GI bleeding do not benefit from ICU care.<sup>1</sup> Unnecessary ICU admissions increase costs and may

## Summary box

### What is already known about this subject?

► The Glasgow-Blatchford Bleeding Score (GBS) was designed to identify low-risk upper gastrointestinal bleeding (UGIB) patients who could be safely discharged from the emergency room. Subsequent studies have shown that the GBS can help predict rebleeding and need for transfusion.

### What are the new findings?

► This study shows that the GBS can be used to identify patients who do not need intensive monitoring after admission.

### How might it impact on clinical practice in the foreseeable future?

► Better understanding and use of predictive tools could help reduce costs and resource allocation associated with treating UGIB.

impede access to other critically ill patients. A recent analysis revealed broad variability in ICU admission for UGIB among different hospitals with no difference in outcomes.<sup>2</sup>

The Glasgow-Blatchford Bleeding Score (GBS) (online supplemental appendix A) was designed to identify low-risk patients (score  $< 1$ ) who could be safely discharged from the emergency room (ER) after presenting with UGIB.<sup>3</sup> More recent studies have shown that the GBS can predict a need for endoscopic intervention,<sup>4</sup> blood transfusion<sup>5</sup> and urgent endoscopy.<sup>6</sup>

The 2010 Toronto consensus guidelines for UGIB advocated risk stratification in the ER using the GBS or another validated tool.<sup>1</sup> In 2012, the Swedish Medical Center began including a GBS for all patients seen in the ER with suspected UGIB. A 'smart phrase' was created in the hospital electronic health record (EHR) (EPIC) to auto-populate relevant fields of the GBS in hope of improving



its use. In addition to identifying very low-risk patients, the score was also used to stratify lower-risk patients to help reduce unnecessary ICU admissions. Analysis at 6 months revealed an 18% reduction in hospital expenses for UGIB patients, about US\$2000 per admission, with no identifiable adverse outcomes, due in large part to shorter lengths of stay and a decrease in admission to ICU.<sup>7</sup> The current study was undertaken to assess the utility of the GBS to direct bed placement for patients with UGIB.

## METHODS:

We reviewed all patients over 18 years of age admitted with symptoms of GI bleeding who were assigned a GBS through Swedish Medical Center's ER between 1 January 2015 and 31 October 2017. ER physicians were asked to insert a GBS template within the body of their admission note in the EHR. The template pulls recent lab data and vital signs from the EHR to populate blood urea nitrogen, haemoglobin level, systolic blood pressure and pulse. Additional boxes address melena, syncope, heart and liver disease history and are manually entered. The EHR then calculates a score from 0 to 23 and places it in the note. The score is accompanied by verbiage suggesting admission to an unmonitored bed (UMB) for patients with a score of 1–7, a monitored, intermediate care (IMCU) bed for a score of 8–12 and ICU placement for a score of 13 or higher, but also notes that physicians may direct patients to a different unit based on clinical judgement, (online supplemental appendix B).

Because of major similarities between IMCU and ICU layout, equipment, staffing and other expenses, as well as frequent flexing of ward designations based on census and staffing, for analysis, admissions to both units were grouped and designated MBs. General medical/surgical ward and telemetry beds were considered UMBs, because of similar staffing levels and cost.

All patients were admitted to hospitalist or intensivist services with hospital-based GI consultation. Urgent endoscopy, within 24 hours of admission, was available for all patients regardless of unit.

Using discharge diagnoses and endoscopic findings, we identified patients who had or were likely to have had an UGIB from any source. Those with bleeds distal to the ligament of Treitz were analysed separately. Those with uncertain bleeding were excluded. We categorised patients by their admitting GBS and determined whether the admitting team followed recommendations for bed assignment. For patients admitted outside of the recommendations, the physicians' notes were used to determine the reason for bed placement and to review the subsequent hospital course. Patients transferred to a higher level of care within the first 48 hours were also reviewed. We collected data on in-hospital mortality, rebleeding, length of stay, transfusion requirement, need for endoscopy and radiographic and surgical interventions. We reviewed in-hospital deaths to determine

**Table 1** Patients admitted with UGIB

GBS	≤7	≥8	P value
No	235	510	
Median age	66	71	0.02
Female	45%	50%	0.49
LOS (average in hours)	70	123	<0.01
Unit assignment by protocol	206 (88%)	361 (71%)	0.03
Underwent urgent endoscopy	150 (64%)	457 (90%)	0.01
Required transfusion	30 (13%)	360 (71%)	<0.01
Experienced rebleed	12 (5%)	71 (14%)	<0.01
Radiographic or surgical intervention	2 (1%)	19 (4%)	0.03
Death	5 (2%)	20 (4%)	0.27

GBS, Glasgow-Blatchford Bleeding Score; LOS, length of stay; UGIB, upper gastrointestinal bleeding.

if they resulted from GI bleeding and whether delay in any intervention may have contributed to mortality. We compared outcomes among groups who received bed assignments within and outside of guidelines. We also reviewed a separate cohort of patients during the same period to calculate the actual use of the GBS for patients with GIB symptoms.

The Fisher's exact test was used for comparison of categorical data, and an independent t-test was used for continuous data. Analyses were performed by using GraphPad Prism statistical software, V.8 (GraphPad Software, La Jolla, California, USA). A  $p < 0.05$  was considered as statistically significant.

## RESULTS:

Over 34 months, 1037 patients were admitted through the ER with a presumption of GIB and also received a GBS. Of these, 745 had evidence of an UGIB, 244 were determined to have had a lower gastrointestinal bleed (LGIB), 23 had evidence of a small bowel bleed and for 25 no cause was identified. Among patients with UGIB, 235 (32%) had a  $GBS \leq 7$  and 510 (68%) scored 8 or higher. Twenty-nine (12%) patients in the low-risk group were admitted to an MB (28 IMCU, 1 ICU) despite guidelines, (table 1). Among patients with scores  $> 7$ , 149 (29%) were admitted to UMBs while 287 went to IMCU and 74 to ICU. Among those who went to ICU 58 had  $GBS \geq 12$ , representing 38% of that group. Low-risk patients were more likely to receive a protocol directed admission than high-risk patients ( $p = 0.03$ ).

Of the 745 patients suspected of having had an UGIB, 607 had this confirmed by upper endoscopy during that admission. The remaining 138 individuals who did not undergo endoscopy all presented with symptoms of haematemesis, melena or profound anaemia and had a documented upper endoscopy within the past year for UGIB that revealed a likely source of recurrent bleeding,

(erosive oesophagitis, alcoholic gastritis, etc). Average time to endoscopy was 19 hours from admission and access to endoscopy was not affected by unit placement. Patients who had previous endoscopy that suggested a likely source of current bleeding and were not felt to need endoscopic therapy did not necessarily undergo repeat endoscopy.

High-risk patients tended to be older, had longer admissions, were more likely to undergo urgent endoscopy, transfusion and experience rebleeding as well as require a non-endoscopic intervention to control bleeding than low-risk patients, but were no more likely to die during admission.

Because the GBS was not universally applied to all patients presenting with UGIB symptoms, we sought to understand rate of use of the GBS score among ER physicians. A separate group of all patients who presented to the ER during the same period with the very specific International Classification of Diseases, tenth revision, clinical modification (ICD-10-CM) codes K92.0 (haematemesis) or K92.1 (melena) were reviewed, as this group represented patients who clearly would have qualified for including a GBS. Of 644 patients, 405 (63%) received a GBS in the ER while 239 (37%) were not scored. Among 47 ER physicians, GBS use ranged from 0% to 92% with the top quartile averaging 81% and the lowest quartile 42%. The 405 patients with scores are included in the study cohort. The remaining study patients received other ICD-10-CM codes at admission.

Within the low-risk group, 29 patients were admitted directly to an MB from the ER. Admission notes suggest concern about rapid deterioration by the ER, hospitalist or GI physician due to a history of cirrhosis and possible oesophageal varices in 3 (10%) patients, other history of alcohol abuse or withdrawal in 6 (21%), advanced age or medical fragility in 7 (24%), very low haematocrit in 4 (14%), new or active bleeding in the ER in 4 (14%) and active infection or sepsis in 2 (7%). No clear reason for MB assignment could be identified for five patients. The presence of liver disease, beyond its effect on the GBS, did not appear to direct patients to an MB.

Low-risk patients who were admitted to UMBs had a lower average GBS than those admitted to MBs. In order to better compare these groups, we excluded four patients admitted to MBs for non-bleeding symptoms such as mental status changes or respiratory symptoms who had a GBS <5 and compared the remaining 25 to a score-matched group of patients (from 5 to 7) admitted to UMBs, (table 2). MB patients were similar to UMB patients in regard to age and gender. Within this cohort, there was no difference in transfusions, rebleeding, frequency of endoscopy or death. Patients admitted to MBs stayed almost a day longer than those in UMBs, but this did not reach significance. None of the low-risk patients admitted to MBs required emergent intubation, cardioversion or vasopressors.

Four (2%) low-risk (GBS ≤7) patients required MB transfer within the first 48 hours (table 3). Three transfers

**Table 2** Low-risk patients with GBS 5–7 admitted to different units

	Unmonitored bed	Monitored bed	P value
No	109	25	
Median age	68	67	0.91
Female	40%	42%	0.98
Average GBS	6.2	6.3	0.45
LOS (av in hours)	71	91	0.14
Underwent urgent endoscopy	76 (70%)	17 (68%)	0.98
Required transfusion	17 (16%)	6 (24%)	0.38
Experienced rebleed	8 (7%)	3 (12%)	0.43
Radiographic or surgical intervention	1 (1%)	1 (4%)	0.35
Death	1 (1%)	1 (4%)	0.35

GBS, Glasgow-Blatchford Bleeding Score; LOS, length of stay.

were made out of caution based on new findings and were discharged home within 2 days. One patient ultimately died due to mesenteric ischaemia despite intubation and aggressive support. None of these patients experienced recurrent bleeding.

He was one of 5 (2%) low-risk patients who died during an admission for UGIB (table 4). All of these patients were elderly and/or had significant underlying illness. Three were had ‘do not resuscitate’ orders or were under palliative care plans at admission. None of these deaths appeared to have directly resulted from GI bleeding.

High-risk patients (GBS ≥8) admitted to MBs did not differ significantly from those admitted to UMB in terms of age or gender but did tend to have a higher average GBS (11.8 vs 10.3 p<0.01). Patients admitted to MBs tended to have a longer length of stay, require blood transfusions and rebleed. Despite this, death rates were similar (table 5).

Ten (6.7%) high-risk patients initially admitted to an UMB required transfer to an MB (table 6). Two (1.3%) eventually died. An 80-year-old man with a GBS of 10 died of aspiration and sepsis. A review suggested that closer monitoring and care from the outset may have prevented this. A 50-year-old woman with a GBS of 9 died of encephalopathy and liver failure despite timely transfer to MB and intubation. The most common reason for transfer was respiratory failure (50%).

## DISCUSSION

GI bleeding represents the most common cause for admission to hospital GI services in the USA, accounting for up to 500 000 admissions per year<sup>8</sup> with 1.9% all-cause mortality.<sup>9</sup> Many UGIB patients present with some degree of haemodynamic instability. Uncertainty about the source of bleeding combined with the spectre of rapid deterioration can lead to ICU admission. Most of these patients however never need specialised ICU services



**Table 3** Low-risk (GBS  $\leq 7$ ) patients who were transferred to MB within first 48 hours

Age	Gender	GBS score	Reason for transfer	Outcome
68	F	4	New atrial fibrillation	Discharge home
30	F	7	Varices banded at endoscopy	Discharge home
77	F	3	Oesophageal ulcer at endoscopy	Discharge home
64	M	4	Lactic acidosis, severe vascular disease	Death

F, female; GBS, Glasgow-Blatchford Bleeding Score; M, male; MB, monitored bed.

such as intubation, central monitoring or urgent cardioversion. ICU and other MBs demand significantly more resources than UMBs and may be a scarce commodity in some hospitals. Admission to an ICU may also lead to more invasive procedures and longer length of stay, without necessarily producing better outcomes.<sup>2</sup> ICU admissions for UGIB vary widely in the USA. A recent study of 94 acute care, non-federal hospitals showed that ICU admission rates for UGIB ranged from 11.5% to 51.2%, without any demonstrable difference in mortality.<sup>2</sup> Another study estimated that up to 40% of ICU admissions for UGIB are unnecessary.<sup>10</sup>

In our own institution, the expense of (not charge for) an ICU bed is about 2.5 times that of an UMB. A step-down or IMCU bed is almost as expensive at about twice the price of an UMB. This is driven largely by higher staffing costs for both units. The level of care in the Swedish IMCU resembles ICU care in many hospitals with large, glass fronted individual rooms with central, remote monitoring and patient to nurse ratios that do not exceed 3:1. In fact, IMCU and ICU rooms are identical and differ in designation only when staffing levels change. In this study, because of the similar costs and level of care provide in ICU and IMCU and frequent shifting of patients between the two units for non-medical reasons, we chose to combine admissions to these two units and compare them to admissions to UMBs, specifically for lower-risk patients. Most patients in this study who were admitted to MBs were actually admitted to IMCU rather than ICU (315 vs 75 or 81%). We felt that because of the broad variation in design and staffing of ICUs and other MBs among different institutions, a clearer distinction in

cost and care could be drawn between monitored and UMBs rather than among multiple different levels of monitoring and care. The goal was not so much to determine whether the GBS identifies an ideal level of care for each person, but rather to see if a score exists below which monitored care may not be necessary.

The decision to direct patients with a GBS  $\leq 7$  to an UMB was not arbitrary. Preventing morbidity and mortality that might result from haemodynamic compromise remains the primary goal of admitting UGIB patients to an MB. A patient in an MB can receive rapid transfusion and fluid replacement, vasopressor support and in extreme cases, undergo intubation and cardioversion. In addition, close nursing support and constant haemodynamic monitoring can theoretically identify sequelae of bleeding more rapidly. But studies suggest that rapid blood loss is unlikely at GBS  $\leq 7$ . Bryant *et al*<sup>11</sup> reviewed 888 patients with UGIB and found no patient who needed endoscopic or surgical intervention had an admission GBS below 8. Chatten *et al*<sup>12</sup> reviewed 399 patients with UGIB and found that over 92% of patients with a GBS  $\leq 8$  did not need endoscopic therapy. Robertson *et al*<sup>13</sup> in a study of 424 patients with UGIB suggested that a GBS of 9 for requiring ICU admission (88% sensitive and 44% specific) and a score of 10 was 76% sensitive and 86% specific for needing transfusion. A cut-off of 7 was felt to exclude the vast majority of patients with active, haemodynamically significant bleeding requiring aggressive support. Ready access to endoscopic diagnosis and intervention for patients in UMBs as well as ability to rapidly transfer deteriorating or unstable patients to an MB provided additional reassurance. Internal review of

**Table 4** Low-risk (GBS  $\leq 7$ ) patients who died during admission for UGIB

Age	Gender	GBS score	Initial admission	Length of hospitalisation (in days)	Cause of death	Code status
64	M	4	UMB	2	Mesenteric ischaemia	Full Code
88	M	4	UMB	7	Aspiration pneumonia	DNR
88	M	6	UMB	3	Congestive heart failure	DNR
66	F	7	MB	7	Cirrhosis, COPD, respiratory failure	Full Code
86	M	7	MB	2	Oesophageal cancer, aspiration pneumonia	DNR

COPD, chronic obstructive pulmonary disease; DNR, do not resuscitate; F, female; GBS, Glasgow-Blatchford Bleeding Score; M, male; MB, monitored bed; UGIB, upper gastrointestinal bleeding; UMB, unmonitored bed.

**Table 5** High-risk patients (GBS  $\geq 8$ ) admitted to different units

	Unmonitored bed	Monitored bed	P value
No	149	361	
Median age	75	71	0.14
Female	52%	49%	0.80
Average GBS	10.3	11.8	0.01
LOS (average in hours)	94	135	0.05
Underwent urgent endoscopy	125 (84%)	329 (91%)	0.57
Required transfusion	77 (52%)	279 (77%)	0.01
Experienced rebleed	10 (7%)	64 (18%)	0.02
Radiographic or surgical intervention	3 (2%)	17 (5%)	0.22
Death	5 (3%)	15 (4%)	0.78

GBS, Glasgow-Blatchford Bleeding Score; LOS, length of stay.

6 months of patient with GBS  $\leq 7$  also suggested safety at this level.

This study demonstrates that the GBS can identify a threshold below which the likelihood of sudden deterioration from bleeding is very low. In the study population, low-risk patients accounted for about a third of those admitted with UGIB. Despite guidelines, 12% of low-risk patients were admitted to MBs. Caution appears to have driven most of these decisions. Despite a higher level of care, the treatments and outcomes for these patients did not differ significantly from those admitted to UMBs. Two patients required intubation yet both died. It is impossible to tell if any of the surviving patients benefited from the higher level of nursing care or haemodynamic monitoring. While five low-risk patients ultimately

died and four others were transferred to MBs, none was the direct result of bleeding. It is not surprising and ultimately appropriate that some very elderly patients or those with terminal conditions were not placed in MBs as aggressive interventions would likely not have changed outcomes. Transfers to MBs that did occur were timely and no adverse outcomes appeared to have resulted from primary UMB placement.

The GBS alone proved less effective for identifying those who truly need an MB. Evidence-based guidelines have suggested that haemodynamically unstable patients and those with GBS  $\geq 12$  may benefit from endoscopy as early as 12 hours after admission.<sup>14–17</sup> Although formal guidelines for ICU care for this group are lacking, it might be assumed that patients unstable enough to benefit from very early endoscopy would also benefit from the highest level of care. However, a small subgroup of 16 patients with a GBS  $\geq 13$  did as well in UMBs as those in MBs. These patients tended to have higher scores due to renal failure or severe anaemia but were otherwise haemodynamically stable.

Roughly half of all UGIB patients had a GBS between 8 and 12. One-third of these patients did well in UMBs and likely others would have as well. However, 10 (8%) patients in this group, initially felt by the ER physician to be low risk, required transfer to an MB. Four had respiratory compromise or aspiration while two developed mental status changes associated with alcohol withdrawal or cirrhosis. Two of these patients ultimately died but neither from ongoing bleeding. Seven other deaths occurred among patients with scores between 8 and 10, despite primary admission to an MB. This is consistent with the findings of other studies that UGIB patients at highest risk of mortality suffer from comorbidities such as alcohol withdrawal, cirrhosis, and cancer<sup>6</sup> and rarely die directly from bleeding.<sup>18</sup> The large number of high-risk patients (32%) who were successfully treated in UMBs suggests that other factors not captured by the GBS such as age, alcohol withdrawal or respiratory compromise should be considered when making bed selection and

**Table 6** High-risk (GBS  $\geq 8$ ) patients initially admitted to an UMB who were transferred to MB within 48 hours

Age	Gender	GBS score	Reason for transfer	Outcome
83	F	9	Respiratory compromise	Discharge home
74	F	9	Recurrent bleeding	Discharge home
50	F	9	Liver and respiratory failure	Death
92	M	10	Respiratory compromise, CHF	Discharge home
78	F	10	Persistent anaemia and arrhythmia	Discharge home
48	M	10	Alcohol withdrawal, encephalopathy	Discharge home
56	M	10	Alcohol withdrawal, aspiration	Discharge home
80	M	10	Aspiration pneumonia	Death
43	M	10	Large duodenal ulcer at endoscopy	Discharge home
75	F	12	Recurrent bleeding	Discharge home

CHF, congestive heart failure; F, female; GBS, Glasgow-Blatchford Bleeding Score; M, male; MB, monitored bed; UMB, unmonitored bed.



that the absence of these conditions may enable safe UMB placement for UGIB patients with a GBS  $\geq 8$ . What the safe GBS upper limit might be and what other factors may be necessary predict safe UMB placement are not identified in this study.

While risk assessment tools aid ICU decision making for other conditions,<sup>19–21</sup> none of the half dozen common risk tools for GI bleeding are widely used for this purpose.<sup>12 22 23</sup> The Rockall Score, Baylor Bleeding Score and Cedars-Sinai Predictive Index rely in part on endoscopic elements that are generally not available to the ER physician.<sup>24</sup> The GBS, the AIMS65 score as well as the clinical Rockall score rely only on vital signs, labs and historical elements that are almost always available in the first hours of evaluation. The GBS has been shown to help predict need for urgent endoscopy<sup>13</sup> and blood transfusion,<sup>20</sup> two factors that might suggest a need for higher level of care,<sup>5</sup> but has not been previously reported as a tool for bed assignment. The GBS remains the most widely studied risk stratification tool for UGIB and appears to be more sensitive than either of the Rockall scores.<sup>4 20</sup>

The AIMS65 score, which incorporates age and albumin level but not subjective or historical elements like syncope and liver disease, appears to be more accurate for predicting mortality and length of stay,<sup>25</sup> but may be less accurate than the GBS for predicting recurrent bleeding or transfusion requirement.<sup>26 27</sup> However, predicting death in patients with advanced age and multiple comorbidities may not clearly translate into better outcomes with early MB admission. The AIMS65 score is easier to memorise and calculate than the GBS, but this advantage fades when the EHR automates it.

Despite recommendations to incorporate them into decision making in the ER, risk scores are not used widely.<sup>1</sup> Many physicians feel that risk scores are not particularly useful or don't work any better than an ER physician's judgement.<sup>28 29</sup> It may also be that even simple scores require too much effort to remember and apply than most busy physicians are willing to invest.

This study shows that by leveraging the data grabbing functions of an EHR, the GBS can be easily incorporated into the ER assessment. But even this feature did not lead to rapid adoption. Only after months of intense education did ER physicians begin to use the GBS calculator regularly, and even then, not consistently. However, once adopted, the GBS began to serve as an efficient short hand among ER physicians, hospitalists and gastroenterologists, replacing a long list of vital signs and labs with a simple, widely understood number.

Because the source of GI bleeding is often unclear at presentation, the ideal risk score would have utility for LGI bleeding as well. While several scores have been proposed to predict mortality and other outcomes for patients with LGI bleeding, studies have emerged showing that the GBS has reasonable accuracy for identifying low-risk patients with LGI bleeding.<sup>30 31</sup> This study supports those findings and demonstrates that the

GBS may effectively identify low-risk patients with LGI bleeding safe for UMBs. A total of 244 patients who were ultimately found to have had lower GI bleeding had a bleeding score calculated at admission. The GBS directed 117 of 133 (88%) low-risk patients to UMBs. None of these patients suffered an adverse event or poor outcome as a result of their bed placement. Four low-risk patients were transferred to MBs within 48 hours. Three who were transferred out of caution due to cirrhosis, alcohol withdrawal and ongoing bleeding were discharged within 48 hours of transfer. One patient with a diverticular source continued to bleed despite angiography and ultimately underwent haemicolectomy.

Any cost savings from using the GBS remains unknown. An earlier review at our institution of 166 UGIB patients revealed that using the GBS along with other elements aimed at improving physician communication decreased ICU admissions by 42%, LOS by 14% and hospital expense by 18%.<sup>7</sup> Chang and Shapiro estimated that if ICU care for UGI bleeding patients in higher utilisation hospitals were reduced to levels of lower utilisation hospitals, total costs would drop by about 6.5%.<sup>2</sup>

Several elements limit this study. First, the GBS for bed placement is limited because it does not take into account comorbidities and risk factors beyond GI bleeding. Many low-risk patients were admitted to MBs based on ER physicians' concerns about other conditions and less than a third were redirected based on a concern about bleeding. Two who died succumbed to respiratory complications without rebleeding and none in this group needed aggressive haemodynamic interventions to control bleeding. But there is no way of knowing whether this small group would have done as well in UMBs. However, this does demonstrate the real world applicability of these guidelines; physicians had no problem admitting outside of guidelines when a patient appeared at higher risk.

Just under a fifth of patients with signs of UGI bleeding did not undergo endoscopy during the index admission. Although all had a diagnostic endoscopy within the last year, the true cause of these bleeds was not documented. The number and types of endoscopic interventions are also not captured in this data, nor are the final diagnoses, incidence of liver disease and bleeding source for all patients. While more granular data may help us better understand which patients are ultimately more likely to rebleed or do poorly, the source of the bleed is almost always obscure at the time of admission and the presence of cirrhosis may also be unknown. The ideal risk score should aid in placement without having to know the source of bleeding if no diagnostic or interventional endoscopy is necessary. In this study, two individuals in the lower-risk group were admitted to MBs because of a concern for varices and one other who was found to have non-bleeding varices after index endoscopy was transferred to the ICU for observation. Others may have had cirrhosis that was not initially identified but did not lead to deterioration or require MB transfer.

During the study period, up to 37% of patients with UGIB may have been missed because some ER physicians did not use the automated system. However, it does not appear that any specific risk groups were excluded. This suggests that, although incomplete, the cohort was representative of patients who present with UGIB. The study also does not look at hospital readmissions or post hospital deaths, although an adverse effect from improper bed placement would likely become apparent during that admission and not after discharge. Some subgroup analyses involve small numbers of patients, limiting the ability to demonstrate differences.

The findings of this study may not be universally applicable. Hospitals, their staffs and their skill sets differ. While patients with a score of 7 may consistently do well in an UMB at a facility where access to endoscopy is easy and ICU beds plentiful, the same may not be true for smaller hospitals with fewer ICU beds and inconsistent specialty coverage. Similarly, some facilities may not have ready access to a 24-hour endoscopy unit and depend on MBs for urgent endoscopy. Although it appears that a GBS  $\leq 7$  predicts a low risk of deterioration, a hospital's unique profile and ability to manage these problems should determine cut-off levels for MB placement or transfer.

## CONCLUSION

This study demonstrates that UGIB patients with a GBS  $\leq 7$  in the ER should be admitted to UMBs in the absence of other major comorbidities or signs of rapid deterioration. The ease with which EHRs can incorporate the score into ER workflows suggests that greater use and acceptance of the tool could reduce unnecessary MB admissions. In its current form, the GBS lacks the precision to serve as the sole determinant of bed placement for higher-risk patients.

**Contributors** DBS is responsible for study design, data analysis and manuscript preparation. REE is responsible for data acquisition, organisation and analysis. JMC participated in study design and manuscript review. KTP, RS and JJB participated in manuscript review and data acquisition.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Ethics approval** The study was conducted with approval of the Swedish Medical Center Institutional Review Board.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** All data relevant to the study are included in the article or uploaded as online supplemental information. Specific information about individual patients is protected by privacy policies and not publicly available.

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